AN ANNOTATED KEY TO THE ECHINODERMS OF THE KAIKOURA PENINSULA

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ABSTRACT

A key to 26 species of intertidal echinoderms from the rocky shores of the Kaikoura region, South Island, New Zealand, (173°42'E, 42°25'S) is presented, together with notes on their distribution and habits.

INTRODUCTION

Although 210 species of echinoderms are known from the east coast of New Zealand (Pawson 1965), Rasmussen (1965) recorded only 12 species from the Kaikoura region of the South Island (173°42'E, 42°25'S). These consisted of four ophiuroids (brittle stars), four holothurians (sea cucumbers), three asteroids (seastars), and one echinoid (sea urchin).

This key covers the more common echinoderms of the Kaikoura region. Where a specimen cannot be identified from this key, reference should be made to Dawbin (1950) and Pawson (1970) for holothurians, Fell (1948) for ophiuroids, and Fell (1947, 1959) for asteroids. The seastar *Coscinasterias calamaria* (Gray) is not included in this key. I believe records of this species from Kaikoura by Bennett (1927) and Rasmussen (1965) were misidentifications of *Astrostole scabra* (Hutton).

KEY

The four echinoderm classes included in this key are easily distinguished, *viz* :-

Body soft, elongated in the oral-aboral axis; usually lying on one side which may be differentiated; mouth surrounded by a ring of tentacles; a number of tube feet may be locomotory; skeleton reduced to small spicules embedded in the body wall. CLASS: HOLOTHUROIDEA.

Body globular, heart-shaped, or flattened into a disc; usually pronounced radial symmetry; no arms; skeleton forming a test of closely-fitting calcareous plates arranged in alternating ambulacral and interambulacral rows; the

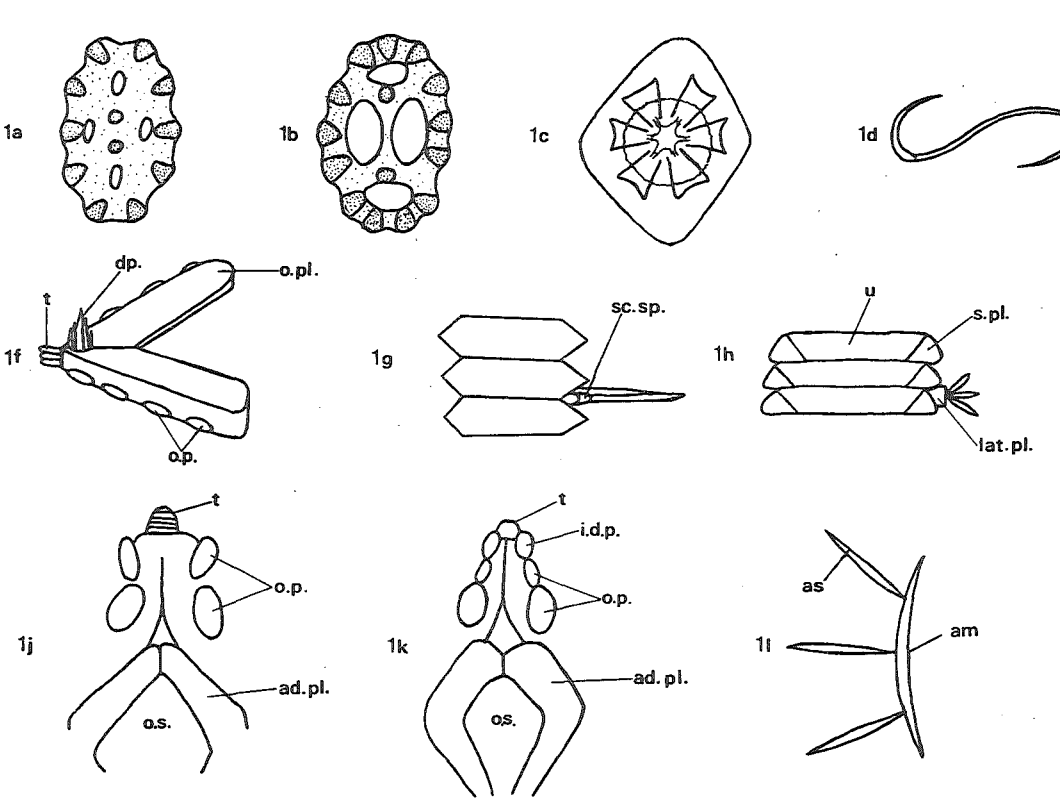

Fig. 1a. Knobbed plate of *Ocnus brevidentis*.

Fig. 1b. Knobbed plate of *Ocnus calcarea*.

Fig. 1c. Six-spoked wheel of *Chirodota mortenseni* and *Trochodota dunedinensis*.

Fig. 1d. Sigmoid hook of *T. dunedinensis*.

Fig. 1e. T.S. asteroid arm showing skeletal plates (ca = cardinals; sup = superomarginals; inf = inferomarginals; ad = adambulacrals; am = ambulacrals).

Fig. 1f. Diagrammatic ophiuroid jaw. (t = teeth; o.pl. = oral plate; o.p. = oral papillae; d.p. = dental papillae).

Fig. 1g. *Ophiopteris antipodum*. Arm segment from above. (sc.sp. = scale-like spines supplementary to uppermost armspine).

Fig. 1h. *Ophionereis fasciata*. Arm segment from above. (u = upper armplate; s.pl. = supplementary plate; lat.pl. = lateral plate).

Fig. 1j. *Ophiactis resiliens*. Jaw. (ad.pl. = adoral plate; o.s. = oral shield).

Fig. 1k. *Amphipholis squamata*. Jaw. (i.e.p. = infradental papillae).

Fig. 1l. *Amphiura hinemoa*. T.S. one side arm segment with lateral plate carrying spines. (am = armplate; as = armspine).

Figs. 1a-1d. from Dawbin (1950). Figs. 1f-1l from Fell (1949).

ambulacral plates pierced with pores for the passage of tube feet; ambulacra extend from the region of the mouth almost to the aboral pole; mouth on the lower surface, and surrounded by a membranous peristome; anus aboral, or displayed posteriorly to the oral side, and surrounded with a membranous, plate-covered periproct. CLASS: ECHINOIDEA.

Animal star shaped, with a central disc continuous with five, or more, arms; the arms contain gonads and part of the alimentary canal; body flattened, with a sharp boundary between the oral and aboral sides; madreporite aboral; ambulacra on the underside of arms, forming open grooves with locomotory tube feet; flexible skeleton of separate ossicles. CLASS ASTEROIDEA.

Animal star shaped, with the arms sharply marked off from the central disc; the arms rarely contain gonads or part of the alimentary canal; madreporite on the oral surface; no anus; ambulacral grooves covered by plates; tube feet usually not locomotory and without suckers. CLASS: OPHIUROIDEA.

A fifth class of echinoderms, the Crinoidea (sea lillies and feather stars), is not represented in the intertidal zone in New Zealand, but is found in the immediate sublittoral in northern waters.

CLASS: HOLOTHUROIDEA

Of the twelve species of intertidal holothurians known from New Zealand (Pawson 1970), six are found around the Kaikoura Peninsula. Species are distinguished primarily on the abundance and form of small calcareous spicules found in the body wall, and occasionally in the tube feet and tentacles. To view these spicules, remove a small piece of body wall and place on a microscope slide. Cover with potassium hydroxide, sodium hydroxide or sodium hypochlorite and heat gently over a bunsen burner for 20-30 seconds. Spread remaining tissue into a thin layer, and cover with a cover slip. Distributional records cited here are from Pawson (1970).

1. Spicules present.....2
   Spicules absent. May occasionally have spicules in the tentacles.....*Kolostoneura novaezelandiae* (Dendy and Hindle).
   White or pinkish-brown. An intertidal species occurring under rocks in mud or sand from Auckland to Stewart Island.
2. Spicules present as knobbed plates.....3
   Not as above.....4
3. Knobbed plates have four primary perforations of equal size, and 8-10 marginal knobs (Fig. 1a). Knobbed cups and curved perforated rods also present. Tentacles 10.....*Ocnus brevidentis* (Hutton).
   Colour in life pink, and up to 40 mm in length. Also occurs on the Auckland, Antipodes, and Chatham Islands at depths of 0-465 m. On shore, occurs under rocks and in algal holdfasts. Offshore, on boulders and in sand or gravel.

Knobbed plates have four primary perforations (two large, two small), and 12-14 marginal knobs (Fig. 1b). Knobbed cups and perforated plates also present. Tentacles 10..... *Ocnus calcarea* (Dendy).

Body white, with sparse, small red tubercles on the upper side. Occurs on rock, in gravel and algal holdfasts. Known from Wellington, Stewart Island and Auckland at depths down to 27 m.

4. Spicules form "six-spoked wheels" (Fig. 1c).....5
Spicules appear as "tables" with a squarish disc, having four large holes and four small ones..... *Stichopus mollis* (Hutton).

The commonest and most conspicuous holothurian in the Kaikoura region. Reaches 250 mm in length. In intertidal pools, and on sand or mud in shallow water. Light mottled brown or black and lighter underneath, with large papillae on the upper surface. Depth range 0-270 m.

5. "Six-spoked wheels" aggregated into papillae. Tentacles 12..... *Chirodota mortenseni* Pawson.

Light pink, red. An intertidal species known from Little Papanui, and Kaikoura. Occurs under stones.

Wheels scattered, never aggregated into papillae. Spicules also present as sigmoid hooks (Fig. 1d), scattered or arranged into groups. Tentacles 10, digits 2-6 on each side..... *Trochodota dunedinensis* (Parker).

Reddish-brown, and found under stones in mud, at depths of 0-180 m. When intertidal, also occurs in tufts of *Corallina*. Range Hawke Bay to Stewart Island.

CLASS: ECHINOIDEA

Only two species of sea urchin occur on the rocky shores of the Kaikoura region. Both species are roughly spherical/subspherical in shape. The five ambulacra are all similar, and traverse the test from apex to peristome in a regular pattern. The anus is situated at the apex, and the mouth occupies the centre of the lower surface. The spines are always shorter than the diameter of the test. Each ambulacral plate carries three or more pairs of pores for the passage of tube feet, and each interambulacral plate carries a number of tubercules of various sizes.

1. Spines distinct green with white tips. Tube feet red-brown, test green and white. Up to 150 mm in diameter..... *Evechinus chloroticus* (Valenciennes).

The common sea egg or kina. Present in intertidal pools, but most abundant subtidally at depths of about 8 m (Dix 1969).

Spines dull green or grey-green. No more than 50 mm in diameter.....*Pseudechinus novaezelandiae* (Mortensen).

Occurs singly under stones in pools. Inconspicuous.

CLASS: ASTEROIDEA

Seventy-five species of seastars are known from New Zealand waters (Clark 1970), and ten of these occur intertidally at Kaikoura. The position of skeletal elements referred to in the key is shown in Fig. 1e.

1. Arms sharply demarcated from the disc.....2
   Arms not sharply demarcated from the disc.....5
2. Upper surface carrying inconspicuous spines or rounded granules..... *Stichaster australis* (Verill).

   Uncommon at Kaikoura. Occurs from North Cape to Bluff. Tenaciously moulds itself to contours of intertidal rocks which are exposed to surf. Brown-white above, cream tube feet. Feeds mainly on barnacles at Kaikoura, although in other localities it has been shown to prefer the mussel *Perna canaliculus* (Paine 1971).

   Not as above.....3
3. Adambulacral plates each with one spine.....4
   Adambulacral plates each with two spines, these being longer than those on the upper surface. 6-10 arms, usually 7...*Astrostole scabra* (Hutton).

   Bright orange tube feet with cream terminal podia. Aboral surface may be brown, grey, purple, blue or a mixture of these. Occurs to depths of 146 m at Kaikoura and offshore specimens tend to be pink, red or pink-white. Occurs from the Three Kings Islands to the Snares. Also found in Tasmania (Dartnall 1969) and the Chatham Islands (McKnight 1967). This species is New Zealand's largest seastar attaining a radius of 360 mm. It is a voracious carnivore favouring chitons and trochid snails.
4. Six arms (sometimes five). Fissiparous (may reproduce asexually, by a splitting of the disc), therefore, usually 3 large and 3 small arms..... *Allostichaster insignis* (Farquhar).

   At Kaikoura, specimens are usually pink-orange above, with cream tube feet. Feeds mainly on barnacles, and occasionally on the gastropod *Rissoina chathamensis*.

   Eight arms, fissiparous, therefore usually 4 large and 4 small arms..... *Allostichaster polyplax* (Muller and Troschel).

   Rare at Kaikoura. Occurs at Stewart Island, in Tasmania and South Australia.

5. Arms bordered above and below by distinct marginal plates.....6
   No distinct marginal plates.....8
6. Large mushroom-shaped paxillae (skeletal plates, sending up erect columns with expanded tips) on the upper surface. Marginal plates, especially inferomarginals, larger near arm tips than at interradial angles.....*Eurygonias hylacanthus* Farquhar.
   This species is most numerous subtidally, but is sometimes found intertidally under stones.
   Not as above.....7
7. No more than four marginal plates in each interradius. A pair of large swollen plates at each armtip..... *Pentagonaster pulchellus* Gray.
   Not common intertidally, but specimens sometimes occur at extreme low water. A particle feeder (Martin 1970), found from Auckland to Otago. Orange to brown in colour, most usually found at depths of 2-40 m.
   More than fifteen marginal plates in each interradius. Penultimate plates, near arm tips, distinctly larger than other marginals.....*Asterodon (Diplodontias) dilatatus* (Perrier).
   Dull red or orange above, white below. Occurs from Cook Strait to the Snares Islands at 0-80 m (Fell 1962).
8. Outline pentagonal, no interradial indentation, no spines. Body thin and domed, lower surface concave. Greenish-grey or pink-white above, white below and mottled with brown patches..... *Stegnaster inflatus* (Hutton).
   Occurs in rock pools in the North Island, and on the Kaikoura and Banks Peninsulas. A predator of mobile prey including crabs, fish and amphipods (Grace 1974).
   Outline roughly pentagonal, usually with interradial indentation, and covered above and below with clusters of small spines.....9
9. Each adambulacral plate has only one spine on its outer side and three spines on its furrow side.....*Patiriella regularis* (Verill).
   The commonest New Zealand seastar and present in Tasmania. (Dartnall 1969). Reaches a maximum depth of 30 m and the species may be blue, orange, green, or a mottled mixture of these. An omnivorous scavenger which spawns in summer (Crump 1971).

Numerous other adambulacral spines and five or six furrow spines.....*Asterina aucklandensis* Koehler.

Rare at Kaikoura. Usually small, and red-pink in colour.

CLASS OPHIUROIDEA

Diagnostic characters of brittle stars are best viewed in dry specimens. A good drying method is immersion in 100% alcohol for one hour, followed by air drying. In cases where arm structure is used, proximal regions produce the most reliable results. Eighty-nine species of brittle stars are known from New Zealand (Baker 1974, 1977). Eleven of these have been recorded from the intertidal zone at Kaikoura, and others undoubtedly occur there.

1. Disc and arms covered only by soft skin, not by calcareous plates..... *Ophiomyxa brevirima* H.L. Clark.

   The intertidal form is purple-brown with dark blotches, and the deep water form is yellow. Occurs throughout New Zealand.

   Disc and arms covered by regularly arranged calcareous plates.....2

2. Armspines scale-like, (Fig. 1 shows the relative positions of armspines and armplates), tightly adpressed to the sides of the arm.....3

   Armspines long, not scale-like, projecting from the sides of the arms.....5

3. 9-10 armspines per lateral armplate... *Ophiopeza maculata* (Verill).

   Red-brown, a large species, sometimes attaining armlengths of 300 mm.

   6-8 armspines per lateral armplate.....4

4. Upper armplates twice as broad as long.....*Ophiopeza cylindrica* (Hutton)

   Grey or black, with white banding on the arms. Comparatively small, with arms up to 30 mm in length.

   Upper armplates as broad as long..... *Ophiopeza gracilis* (Mortensen).

   Occurs under stones or in crevices at depths down to 30 m.

5. A vertical clump of dental papillae (Fig. 1f shows the position of ophiuroid jaw structures) at the tip of each jaw. Armspines flattened, disc covered with granules.....6

   No clump of dental papillae.....7

6. Uppermost armspine of each cluster bears supplementary scale-like spines at its base (Fig. 1g).....*Ophiopteris antipodum* Smith.

   Black or dark purple. Occurs from North Auckland to the Snares Islands (Horning 1977) under stones, in algal holdfasts and shell/sand.

   No supplementary armspines.. *Clarkoma bollonsi* (Farquhar).

7. Upper armplates each with a supplementary armplate on either side (Fig. 1h).... *Ophionereis fasciata* Hutton.
   Grey, arms banded with brown and white. Numerically conspicuous at Kaikoura. Arms to 125 mm in length. Occurs intertidally in algal holdfasts, and under stones on sand or gravel. A detrital feeder (Pentreath 1970).
   Upper armplates without a supplementary armplate.....8
8. Two oral papillae on each side of each jaw, the outermost one larger. No infradental papillae (Fig. 1j)..... *Ophiactis resiliens* Lyman.
   Olive above, marked with green. Occurs in crevices, algal holdfasts, sponges and under stones. A phytoplankton feeder (Pentreath 1970).
   Infradental papillae on each side of each jaw, one or two distal oral papillae.....9
9. Two distal oral papillae, outermost distal oral papillae twice as wide as others (Fig. 1k)..... *Amphpholis squamata* (Delle Chiaje).
   Common intertidally in pools, coralline sand and shell fragments. Grey in colour, arms to 16 mm in length.
   One distal oral papilla on each side of jaw.....10
10. Three armspines on each lateral armplate (Fig. 1l)..... *Amphiura hinemoa* Mortensen.
   Whitish in colour, arms to 25 mm, disc 6-8 mm.
   Six or seven armspines on each lateral plate.....*Amphiura pusilla* Farquhar.
   Small, arms to 12 mm, disc to 3 mm.

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